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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/709,020	11/08/00	BENNING C	MSU-04769

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EXAMINER
PAK, Y

ART UNIT	PAPER NUMBER
1652	4

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Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary	Application No.	Applicant(s)	
	09/709,020	BENNING ET AL.	
	Examiner	Art Unit	
	Yong Pak	1652	

-- The MAILING DATE of this communication appears on the cover sheet with the correspond nce address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-14* is/are pending in the application.

4a) Of the above claim(s) *6-12* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-5,13 and 14* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

15) ☒ Notice of References Cited (PTO-892)
16) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948)
17) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
18) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
19) ☐ Notice of Informal Patent Application (PTO-152)
20) ☐ Other:

DETAILED ACTION

Claims 1-14 are pending.

Election/Restrictions

Restriction to one of the following inventions is required under 35 U.S.C. 121:

I. Claims 1-5 and 13-14, drawn to a method of producing sulfoquinovose diacylgycerol and a method of making uridine-5'-diphospho sulfoquinovose, classified in class 435, subclass 97.

II. Claims 6-11, drawn to a method of producing long-chain alkyl sulfoquinovoside, classified in class 435, subclass 97.

III. Claim 12, drawn to long-chain alkyl sulfoquinovoside, classified in class 514, subclass 24.

The inventions are distinct, each from the other because of the following reasons:

Inventions II and III are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case the product can by chemically synthesized.

The methods of Inventions I and II are patentably distinct as employing different products. Invention I uses a peptide capable of transferring sulfoquinovose and Invention II uses an acid catalyst and alcohols.

During a telephone conversation with Peter Carrol on April 20, 2001 a provisional election was made with traverse to prosecute the invention of Group I, claims 1-5 and

13-14. Affirmation of this election must be made by applicant in replying to this Office action. Claims 6-12 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a petition under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Drawings

Drawings filed concurrently with the application has been objected by the Draftsman. Please refer to the attached PTO-948 form for details.

Specification

The sequences in Figure 3 should be identified by SEQ ID numbers and must comply with the Sequence Rules, see 37 CFR 1.821-1.825.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claim1, with dependent claims 2-5, are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claim 1 is drawn to a method of using a polypeptide that catalyzes the conversion of UDP-glucose to UDP-sulfoquinovose and another polypeptide that transfers sulfoquinovose from UDP-sulfoquinovose to diacylglycerol. Therefore, these claims are drawn to a method using a genus of polypeptides, with any structure and from any source. The specification only teaches one representative species, *sqd1* (encoding an enzyme capable of converting UDP-glucose to UDP-sulfoquinovose) of SEQ ID NO:6 from *Arabidopsis thaliana.* Also, the specification only teaches sulfolipid synthase, *sqdX*, (encoding enzymes capable of transferring sulfoquinovose to diacylglycerol) of SEQ ID NO:1 from *Cyanobacterium synechococcus* and SEQ ID NO:3-5 from *A. thaliana*. There is no evidence on the record of the relationship between the structure of SQD1 and the structure of SQD1 from another source. Further, sulfolipid synthase from *C. synechococcus* and *A. thaliana* share only about 30% sequence similarity and therefore, there is no relationship between the structure of *sqdX* from *C. synechococcus* or *A. thaliana* to other *sqdX* from another source. Therefore, the specification fails to describe other representative species by any identifying characteristics or structural properties other than the functionality of SQD1 activity and sulfolipid synthase activity.

Claim 1 is also drawn to a genus of sulfur donors. Art teaches that the identity of the sulfur donor in sulfolipid biosynthesis is unknown (Mulichak et al, page 13097 3rd paragraph and abstract). It is unpredictable if intermediates of the SQD1 reaction will accept a sulfite from any species from the genus of sulfur donors. Therefore, the specification does not describe the common characteristics of a suitable sulfur donor.

Given this lack of description of the representative species encompassed by the genus of the claims, the specification fails to sufficiently describe the claimed invention in such full, clear, concise, and exact terms that a skilled artisan would recognize that applicants were in possession of the inventions of claim 1, with dependent claims 2-5.

Claim 1, with dependent claims 2-5, are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for a method of producing SQDG using SQD1 of SEQ ID NO:6 and sulfolipid synthase of SEQ ID NO: 1 and 2-5 and enzymatically active fragments thereof, does not reasonably provide enablement for a method of producing SQDG using SQD1 with structures different from SEQ ID NO:6, sulfolipid synthase with structures different from SEQ ID NOs:1 and 2-5, and using any sulfur donors. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the invention commensurate in scope with these claims.

Factors to be in In re Wands 858 F.2d 731, 8 USPQ2nd 1400 (Fed. Cir, 1988). They include (1) the quantity of experimentation necessary, (2) the amount of direction or guidance presented, (3) the presence or absence of working examples, (4) the nature

of the invention, (5) the state of the prior art, (6) the relative skill of those in the art, (7) considered in determining whether undue experimentation is required, are summarized the predictability or unpredictability of the art, and (8) the breadth of the claims.

Despite knowledge in the art for the isolation of amino acids, the specification fails to provide guidance regarding how to isolate SQD1 different from the enzyme encoded by SEQ ID NO:6. The specification also fails to provide guidance regarding how to isolate sulfolipid synthases different from enzymes encoded by SEQ ID NO:1 and 2-5. Further, art teaches that the identity of the sulfur donor is unknown and thus it is unpredictable if intermediates of SQD1 reaction will accept a sulfite from any sulfur donors. ~~The~~ Therefore, the breadth of these claims is much larger than the scope enable by the specification.

The predictability as to the level of conservation between the disclosed sequences and those of other enzymes capable of converting UDP-glucose to UDP-sulfoquinovose and other enzymes capable of transferring sulfoquinovose to diacylglycerol is extremely complex. While recombinant techniques are available, it is not routine in the art to screen large numbers of amino acids where the expectation of obtaining similar sequences is unpredictable. The amino acid sequence determines the structural and functional properties of an enzyme. Knowledge of which sequences can be altered or removed and still result in similar protein activity is well outside the realm of routine experimentation.

Therefore, one of ordinary skill would require guidance in order to produce SQDG using SQD1 with structures different from SEQ ID NO:6 and sulfolipid synthase

with structures different from SEQ ID NOs: 1 and 2-5 in a manner reasonably correlated with the scope of the claims. Without such guidance, the experimentation left to those skilled in the art is undue.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-2, 5 and 13-14 are rejected under 35 U.S.C. 102(b) as being anticipated by Essigmann et al.

Essigmann et al. teach how to make sulfoquinovosyldiacyglycerol (SQDG) using UDP-glucose, a sulfur donor, SQD1, and a sulfolipid synthase that catalyzes transfer of the sulfoquinovose to diacylglycerol (page 31, Fig.1, and page 31, 3rd paragraph through 4th paragraph). Essigmann et al. teach that SQD1 converts UDP-glucose to UDP-sulfoquinovose (page 31, 4th paragraph) and the SQD1 gene is 100% identical to SEQ ID NO:6 of the instant invention (GenEmbl database – Accession # AF022082). Essigmann et al. also teach that sulfite can be used as the sulfur donor (and page 40, 3rd paragraph). The Therefore, the teachings of Essigmann et al. anticipate claims 1-2, 5 and 13-14.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Essigmann et al. in view of Guler et al.

Essigmann et al. teach how to make sulfoquinovosyldiacyglycerol (SQDG), as discussed above. Essigmann et al. do not teach how to make SQDG using polypeptides encoded by *sqdX*.

Guler et al. teach a *sqdX* gene encoding a sulfolipid synthase catalyzing the transfer of sulfoquinovose from UDP-sulfoquinovose onto diacylglycerol (page 545, 1st paragraph). *sqdX* is 100% identical to SEQ ID NO:1 of the instant invention (GenEmbl database – Accession #U45308). Guler et al. teach that the *sqdX* gene product is essential for sulfolipid biosynthesis in cyanobacteria (page 545, 1st paragraph).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the claimed invention was made to make SQDG with the polypeptide encoded by *sqdX* of Guler et al. The motivation of using the *sqdX* gene product is that the encoded enzyme is essential for cyanobacterial sulfolipid biosynthesis and provides the means to study the last reaction of sulfolipid biosynthesis in greater detail in cyanobacteria, which possesses photosynthetic system like that of eukaryotic

photosynthetic organisms. Production of SQDG is attractive because sulfolipids are possible anti-tumor and anti-HIV therapeutics.

Claims 1-2 and 4-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Essigmann et al. in view of Mulichak et al.

Essigmann et al. teach how to make sulfoquinovosyldiacyglycerol (SQDG), as discussed above. Essigmann et al. do not teach how to make SQDG using various sulfur groups.

Mulichak et al. teach possible sulfur donors, free sulfite, adenoxyl-5'-phosphosulfate, 3'-phosphoadenosyl-5'-phosphosulfate, and protein sulfur donors that may be used in SQDG biosynthesis (page 13101, 1st paragraph). Mulichak et al. teach that the sulfur donor is unknown and proposes the above possible sulfur donors by studying the solvent cavity, the likely binding site of a sulfur donor substrate, of the crystal structure of SQD1 from *A. thaliana* (page 13097 3rd paragraph and abstract).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the claimed invention was made to make SQDG with one of the sulfur donors taught by Mulichak et al. The motivation of using one of the sulfur donors taught by Mulichak et al. is to determine which sulfur donor facilitates the most effective yield of SQDG, a possible anti-tumor and anti-HIV therapeutic. One of ordinary skill in the art would have had a reasonable expectation of success since Mulichak et al. deduced the sulfur donors by studying the binding site of the sulfur donor substrate derived from the crystal structure of SQD1.

No claims are allowed.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Yong Pak whose telephone number is 703-308-9363. The examiner can normally be reached on Monday through Friday from 8:30 a.m. to 5:00 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dr. Ponnathapura Achutamurthy, can be reached on (703) 308-3804. The fax phone number for the organization where this application or proceeding is assigned is 703-308-0294.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0196.

Yong Pak
Patent Examiner

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April 26, 2001